

WHAT IS CLAIMED IS:

1. A desulfurization process comprising:
 - (a) introducing a gaseous hydrocarbon-containing fluid into a reactor via a hydrocarbon inlet, wherein said reactor defines a reaction zone and a disengagement zone, wherein said disengagement zone is disposed above said reaction zone, wherein said disengagement zone is broader than said reaction zone, wherein said reactor comprises a series of substantially horizontal, vertically spaced, cross-hatched baffle groups disposed in said reaction zone;
 - (b) introducing a plurality of solid sorbent particles into said reaction zone via a sorbent inlet located below at least a portion of said baffle groups;
 - 10 (c) forming a fluidized bed of said sorbent particles in said reaction zone by causing said hydrocarbon-containing fluid to flow upwardly through said sorbent particles; and
 - (d) transferring sulfur from said hydrocarbon-containing fluid to said fluidized sorbent particles.

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2. The desulfurization process according to claim 1, wherein said solid sorbent particles have a mean particle size in the range of from about 20 to about 150 microns.

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3. The desulfurization process according to claim 2, wherein step (c) includes causing said hydrocarbon-containing fluid to flow upwardly through said reactor at a superficial velocity in the range of from about 0.25 to about 5 ft/sec.

4. The desulfurization process according to claim 1, wherein said sorbent particles have a Group A Geldart Classification.

5 5. The desulfurization process according to claim 1, wherein step (c) includes causing a substantial portion of said sorbent particles to move above said sorbent inlet.

10 6. The desulfurization process according to claim 1, wherein step (c) includes forming a fixed fluidized bed of said sorbent particles in said reaction zone.

7. The desulfurization process according to claim 1, wherein said sorbent inlet is located below all of said baffle groups.

15 8. The desulfurization process according to claim 1, further comprising;
(e) withdrawing at least a portion of said sorbent particles from said reaction zone at a sorbent outlet located above said hydrocarbon inlet.

20 9. The desulfurization process according to claim 8, wherein said sorbent outlet and said sorbent inlet are both located below all of said baffle groups.

10. The desulfurization process according to claim 1, wherein each

of said sorbent particles comprises nickel.

11. The desulfurization process according to claim 1, wherein each
of said sorbent particles comprises zinc oxide, wherein step (d) includes converting at
5 least a portion of said zinc oxide to zinc sulfide to thereby form sulfur-loaded sorbent
particles.

12. The desulfurization process according to claim 11, further
comprising;

- 10 (f) transferring at least a portion of said sulfur loaded sorbent particles from said
reactor to a regenerator; and
- (g) contacting said at least a portion of said sulfur loaded sorbent particles with an
oxygen-containing regeneration stream in said regenerator to thereby convert
at least a portion of said zinc sulfide to zinc oxide and provide oxidized
15 sorbent particles.

13. The desulfurization process according to claim 12, further
comprising;

- 20 (h) transferring at least a portion of said oxidized sorbent particles from said
regenerator to a reducer; and
- (i) contacting said at least a portion of said sulfur loaded sorbent particles with a
hydrogen-containing regeneration stream in said reducer to thereby provide
reduced sorbent particles.

14. The desulfurization process according to claim 13, further comprising;

(j) transferring at least a portion of said reduced sorbent particles from said reducer to said reactor for introduction into said reaction zone in accordance
5 with step (b).

15. The desulfurization process according to claim 14, wherein said sorbent comprises a promoter metal component comprising nickel, wherein step (g) causes oxidation of said promoter metal component, wherein step (i) reduces the
10 valence of said promoter metal component.

16. The desulfurization process according to claim 1, wherein each of said baffle groups includes a plurality of substantially parallelly extending laterally spaced elongated baffles, wherein said elongated baffles of adjacent ones of said
15 baffle groups extend transverse to one another at a cross-hatch angle in the range of from about 60 to about 120 degrees.

17. The desulfurization process according to claim 16, wherein none of said elongated baffles of adjacent ones of said baffle groups extend parallel to
20 one another.

18. The desulfurization process according to claim 16, wherein each of said elongated baffles is spaced from all other elongated baffles of the same baffle group.

19. The desulfurization process according to claim 1, wherein the height to width ratio of said reaction zone is in the range of from about 2:1 to about 15:1, wherein the height to width ratio of said fluidized bed is in the range of from 5 about 2:1 to about 7:1.

20. The desulfurization process according to claim 1, wherein said hydrocarbon-containing fluid comprises a hydrocarbon selected from the group consisting of gasoline, cracked-gasoline, diesel fuel, and mixtures thereof.

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21. A fluidized bed reactor for contacting an upwardly flowing gaseous hydrocarbon-containing stream with solid particulates, said fluidized bed reactor comprising:

an elongated upright vessel defining a lower reaction zone within which said
5 solid particulates are substantially fluidized by said gaseous hydrocarbon-containing stream and an upper disengagement zone within which said solid particulates are substantially disengaged from said hydrocarbon-containing stream, wherein said disengagement zone is broader than said reaction zone, wherein said vessel defines a solids inlet for introducing said solid particulates into said reaction zone; and
10 a series of vertically spaced contact-enhancing members generally horizontally disposed in said reaction zone, wherein each of said contact-enhancing members includes a plurality of substantially parallelly extending laterally spaced elongated baffles, wherein said elongated baffles of
15 adjacent ones of said contact-enhancing members extend transverse to one another at a cross-hatch angle in the range of from 60 degrees to about 120 degrees, wherein said solids inlet is located below at least a portion of said contact-enhancing members.

20 22. The fluidized bed reactor according to claim 21, wherein said solids inlet is located below all of said contact-enhancing members.

23. The fluidized bed reactor according to claim 21, wherein all of
said elongated baffles of each contact-enhancing member are spaced from one
another.

5 24. The fluidized bed reactor according to claim 23, wherein all of
said elongated baffles of each contact-enhancing member extend substantially parallel
to one another.

10 25. The fluidized bed reactor according to claim 21, further
comprising a distributor plate defining the bottom of said reaction zone, wherein said
distributor plate defines a plurality of holes for allowing the hydrocarbon-containing
stream to flow upwardly through said distributor plate and into said reaction zone.

15 26. The fluidized bed reactor according to claim 25, wherein said
vessel defines a solids outlet for withdrawing said solid particulates from said reaction
zone, wherein said solids outlet and said solids inlet are vertically positioned above
said distributor plate and below all of said contact-enhancing members.

27. The fluidized bed reactor according to claim 21, wherein the
vertical spacing between adjacent ones of said contact-enhancing members is in the
range of from about 0.02 to about 0.5 times the height of said reaction zone.

28. The fluidized bed reactor according to claim 27, wherein each
of said contact-enhancing members defines an open area through which said

hydrocarbon-containing stream and said solid particulates may pass, wherein said open area of each of said contact-enhancing members is in the range of from about 40 to about 90 percent of the cross-sectional area of said reaction zone at the vertical location of that respective contact-enhancing member.

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29. The fluidized bed reactor according to claim 21, wherein the height to width ratio of said reaction zone is in the range of from about 2:1 to about 15:1.

30. The fluidized bed reactor according to claim 29, wherein the maximum cross-sectional area of said disengagement zone is at least two times larger than the maximum cross-sectional area of said reaction zone.

31. The fluidized bed reactor according to claim 21, wherein said elongated baffles of adjacent ones of said contact-enhancing members extend substantially perpendicular to one another.

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32. The fluidized bed reactor according to claim 31, wherein each of said baffles is a generally cylindrical bar or tube having a diameter in the range of from about 1.5 to about 3 inches and wherein said baffles are laterally spaced from one another in the range of from about 4 to about 8 inches on center.

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33. The fluidized bed reactor according to claim 21, wherein said vessel defines a fluid inlet for receiving said gaseous hydrocarbon-containing stream

in said reaction zone, a fluid outlet for discharging said gaseous hydrocarbon-containing stream from said disengagement zone, said solids inlet for receiving said solid particulates in said reaction zone, and a solids outlet for discharging said solid particulates from said reaction zone, wherein said solids inlet, said solids outlet, said 5 fluid inlet, and said fluid outlet are separate from one another.

34. The fluidized bed reactor according to claim 33, further comprising a filter positioned proximate said fluid outlet and operable to allow said gaseous hydrocarbon-containing stream to flow through said fluid outlet while blocking the passage of said solid particulates through said fluid outlet.